Announcements

- Homework for tomorrow…

  (Ch. 25, CQs 10, Probs. 16, 34, & 38)

- PHYS 132 labs begin THIS week!

- Office hours…

  MW 10-11 am
  TR 9-10 am
  F 12-1 pm

- Tutorial Learning Center (TLC) hours:

  MTWR 8-6 pm
  F 8-11 am, 2-5 pm
  Su 1-5 pm

Chapter 25

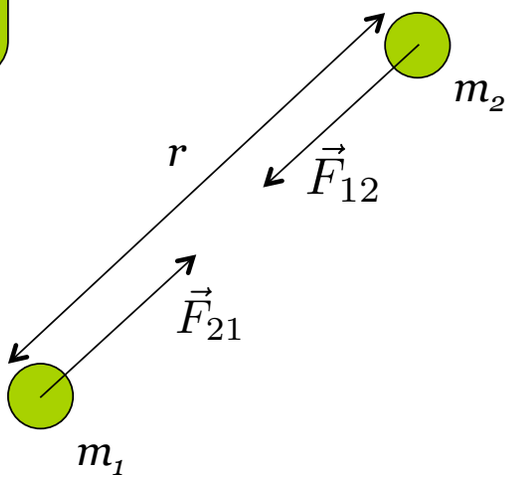
Electric Forces & Charges

(*Coulomb's Law*)

Newton's Law of Gravitation, revisited..

$$F_{12} = F_{21} = \frac{Gm_1m_2}{r^2}$$

where $G = 6.67 \times 10^{-11} \frac{N \cdot m^2}{kg^2}$



Notice:

- Mass is always *positive*.
- Gravity is *always attractive*.
- $\vec{F}_{12} = -\vec{F}_{21}$

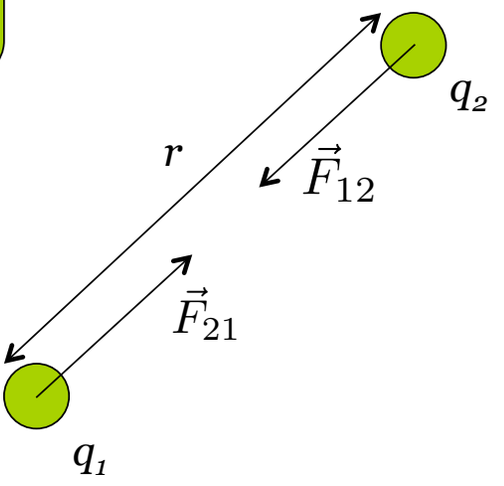
Coulomb's Law..

$$F_{12} = F_{21} = \frac{K|q_1||q_2|}{r^2}$$

where $K = 8.99 \times 10^9 \frac{N \cdot m^2}{C^2}$

Coulombs law

$F_{12} = \frac{K|q_1||q_2|}{r^2}$



Notice:

- Charges can be *positive* or *negative*.
- Force can be *attractive* or *repulsive*.
- $\vec{F}_{12} = -\vec{F}_{21}$

Coulomb's Law - restrictions

charges must be small compared to their separation ("point-like")

OK

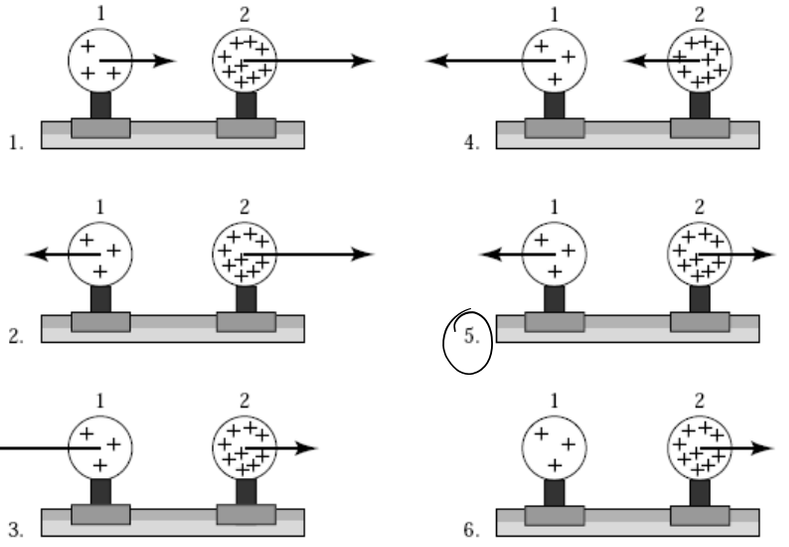
Not OK

Quiz Question 1

Two uniformly charged spheres are firmly fastened to and electrically insulated from frictionless pucks on an air table. The charge on sphere 2 is *three times* the charge of sphere 1.

Which force diagram correctly shows the magnitude and direction of the electrostatic force on each object?

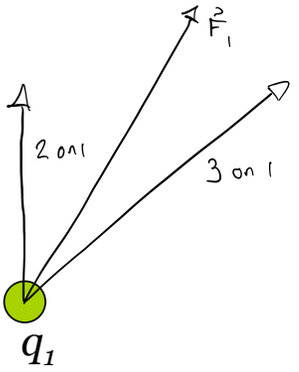
Same magnitude of forces



7. none of the above

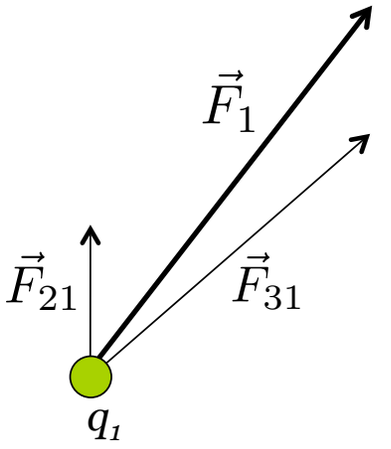
Coulomb's Law and Superposition

- Q: What is the $\vec{F}_1$?



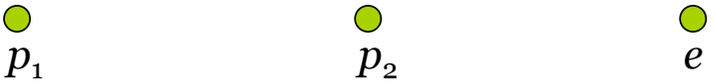
Coulomb's Law and Superposition

- Q: What is the $\vec{F}_1$?
- A: $\vec{F}_1 = \vec{F}_{21} + \vec{F}_{31}$



Quiz Question 2

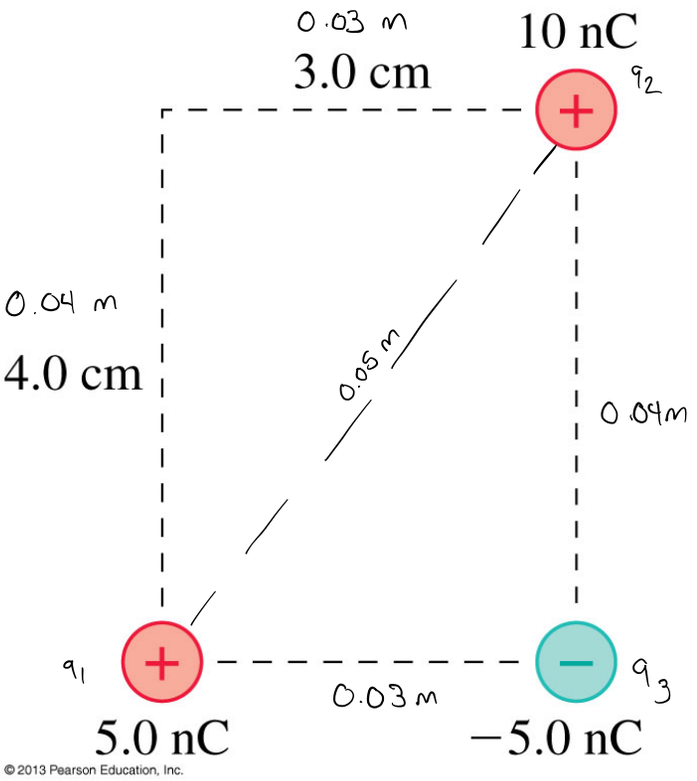
Two protons (p_1 and p_2) and an electron (e) lie on a straight line as shown. The *direction* of the net force on p_1, p_2, and e, respectively, are:

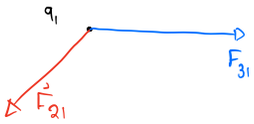


1. left, right, left
2. left, right, right
3. right, left, left
4. right, left, right
5. right, right, left

Prob. 25.37

What is the force ***F*** on the 5.0 nC charge in Figure P25.37? Give your answer as a magnitude and an angle measured cw or ccw (specify which) from the + *x*-axis.





$$F_{21} = \frac{K|q_1||q_2|}{r^2}$$

$$= \frac{8.99\times10^{9}\ \frac{Nm^2}{C^2}\,(5.0\times10^{-9}\,C)(10\times10^{-9}\,C)}{(5.0\times10^{-2}\,m)^2}$$

$$F_{21} = 1.8\times10^{-4}\,N$$

$$F_{31} = \frac{K|q_3||q_1|}{r^2} = \frac{\left(8.99\times10^{9}\ \frac{Nm^2}{C^2}\right)(5.0\times10^{-9}\,C)(5.0\times10^{-9}\,C)}{(3.0\times10^{-2}\,m)^2}$$

$$F_{31} = 2.5\times10^{-4}\,N$$

$$\vec{F}_{31} = (2.5\times10^{-4}\,N)\hat{i}$$

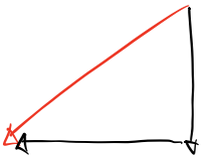
$q_1 = 5.0\times10^{-9}\,C$

$q_2 = 10\times10^{-9}\,C$

$q_3 = 5.0\times10^{-9}\,C$

$$\tan\theta = \frac{y}{x}$$

$$\theta = \tan^{-1}\left(\frac{y}{x}\right)$$



$F_{21}\cos\theta = 1.4\times10^{-4}\,N$

$F_{21}\sin\theta = 1.1\times10^{-4}\,N$

Prob. 25.16

What is the net electric force on charge *A* in Figure EX25.16?